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ABSTRACT

A survey of 1978-79 graduate degree recipients in physics and astronomy was undertaken to determine the characteristics of students and employment opportunities. Information is presented on: employment offers for new physics masters and doctorate recipients, 1974-79; characteristics of the 1978-79 graduate physics student population, and of minority group members; graduate physics students by subfield and years of graduate study completed, sources of support for graduate physics students by sex and degree status; number of advanced graduate physics students specializing in selected experimental or theoretical subfields by years of graduate study completed; types of research performed by doctoral candidates with respect to years of graduate study completed; employment offers for 1978-79 doctorate recipients by subfield and type of research; post-degree plans of physics terminal master's degree recipients; employment plans of terminal masters by subfield; type of employer and work activity of physics terminal masters; background characteristics and postdoctorate status of 1978-79 physics graduates; use of physics in potentially permanent employment of graduate degree recipients; and median monthly salaries paid by U.S. employers to new physics graduates. Information is also presented on graduate astronomy students by subfield and years of graduate study completed, characteristics of astronomy graduate students, and background characteristics and postdoctorate status of astronomy doctorate recipients. (SW)

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AIP report MANPOWER STATISTICS DIVISION

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1978–79 GRADUATE STUDENT SURVEY

by Susanne D. Ellis

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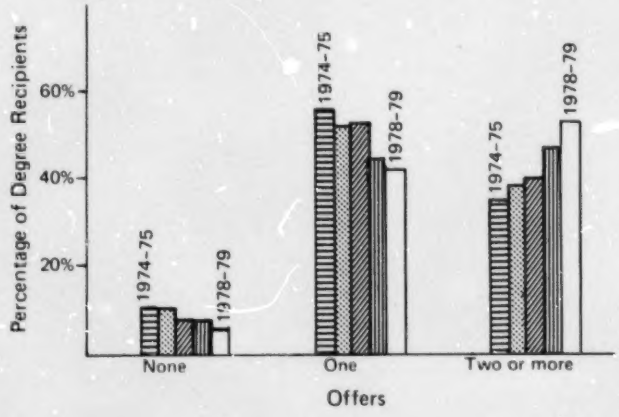
The characteristics and employment opportunities of both physics and astronomy students are included in this annual Graduate Student Survey which has been conducted since the early 1960's. Astronomy students were added to the survey five years ago. Highlights of this report are:

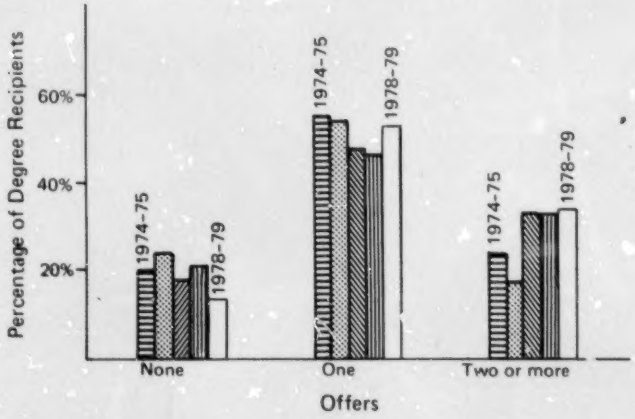
- following a nine-year decline, the number of physics doctorate recipients levelled off
- although the job market continues to improve for doctoral graduates, more physicists accepted 'postdocs'
- a levelling occurred of the graduate astronomy enrollment at 700 with 90 doctorates granted annually

Fig. I. Employment offers for new physics doctorate recipients 1974–79



A look at **Figures I** and **II** leaves no doubt about a favorable and improving job market for new physicists between the mid- and late 1970's. The first set of bars in each histogram depicts graduates interested in immediate employment but without success in securing job offers. For the doctoral graduates, presented in **Figure I**, the range in percentage of graduates with zero job offers is from 10% to 6%. That same statistic for masters seeking immediate employment is 24% to 12%.

Fig. II. Employment offers for new physics masters 1974–79



Further proof of an improving job market can be found in **Figures I** and **II** by examining the decrease or levelling of the cluster of bars depicting the percentage with "one job offer" and the distinct increase of the proportion of graduates who received multiple job offers.

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Table I. Characteristics of the graduate physics student population, 1978–79

Characteristics		All graduate students	First-year graduate students	Degree recipients: Terminal masters	Degree recipients: Doctorate recipients
	Total Population:	9813	2458	653	1033
	Number of respondents:	6334	1299	400	621
Sex	Female	8%	9%	10%	7%
	Male	92	91	90	93
Citizenship	U.S.	77%	83%	85%	76%
	Foreign	23	17	15	24
Type of high school physics	PSSC	32%	27%	31%	35%
	Project physics	6	8	7	3
	Other	55	54	51	57
	None	7	11	11	5
Type of bachelor's institution	PhD-granting	52%	54%	42%	54%
	MS-granting	9	11	18	6
	BS/BA-granting	18	20	26	18
	Foreign	21	15	14	22
Major of bachelor's degree	Physics	89%	86%	85%	94%
	Mathematics	3	4	3	1
	Engineering	4	4	3	2
	Other	4	6	9	3
Type of graduate institution	PhD-granting	93%	87%	73%	100%
	MS-granting	7	13	27	–
Student status	Full-time	89%	84%	82%	89%
	Part-time	11	16	18	11
Source of support	Teaching assistantship	34%	51%	41%	15%
	Research assistantship	39	14	14	56
	Fellowship	10	12	6	8
	Employment	9	12	25	13
	Family, savings, loan	2	4	4	3
	Other	6	7	10	5

The characteristics of the graduate physics student population examined in **Table I** were expanded over previous years to include "major of bachelor's degree". The reason for adding this eighth characteristic was to respond to questions that deal with the influx into physics from other disciplines. Thus the data in **Table I** show that 11% of all graduate physics students were undergraduates in other disciplines. However, those who pursue their studies through to a PhD, include only 6% with nonphysics bachelor's degrees, while terminal masters include 15% from other undergraduate disciplines.

A comparison of the characteristics with those analyzed in previous years points to a further increase in foreign graduate students. Where the first-year students are concerned, fewer of them study on a full-time basis, fewer hold teaching assistantships and more of them engage in off-campus employment as a source of support.

As the number of minority respondents to this annual survey increases, analyses of those data become more meaningful.

Table II presents five characteristics reported by 1346 individual graduate physics students who identified themselves as members of a specific minority group. Respondents who checked "other" and did not specify the minority group, are not included in **Table II**. By far the largest minority group is that of Orientals; and while most of the smaller groups are either predominantly foreign or predominantly U.S. citizens, Orientals include substantial numbers from both groups and are thus analyzed further in **Table II**. As the number of minority respondents fluctuates from year to year, only in some cases are these fluctuations directly proportional to the enrollment of these groups. Asian Indians, Orientals and Arabs are examples of minority groups who increased their enrollments substantially in the graduate physics departments of American universities. On the other hand, attitudes change from year to year which influences the willingness of students to identify themselves on our questionnaires, and thereby cause fluctuations.

Table II. Characteristics of minority group graduate physics students, 1978–79.

Characteristics		Black	American Indian	Puerto Rican	Mexican American	Other Latin American	Asian Indian	Oriental		Arab
								U.S.	Foreign	
	Total number:	77	5	16	27	116	326	102	531	146
Sex	Female	7	2	4	3	18	35	9	59	13
	Male	70	3	12	24	98	291	93	472	133
Citizenship	U.S.	58	5	16	22	10	7	102		3
	Foreign	19	–	–	5	106	319		531	143
Full-time equivalent years of graduate study	≤ 1	21	1	4	11	17	40	20	86	21
	2	10	1	7	7	33	58	17	124	43
	3	15	1	–	1	23	66	18	88	29
	4	10	1	–	–	11	49	19	75	26
	5	6	–	–	2	20	44	9	64	15
	6	10	1	2	[illegible]	4	32	7	54	2
	≥ 7	5	–	3	1	8	37	12	40	10
Student status	Full-time	64	3	10	17	108	314	94	515	142
	Part-time	13	2	6	10	8	12	8	16	4
Subfields	Astrophysics	2	1	1	4	4	5	3	4	3
	Electron, atomic, molec.	8	1	4	2	8	19	6	27	17
	Elem. particles	4	–	2	–	19	34	13	69	17
	Nuclear	11	–	1	1	5	43	7	49	38
	Optics	3	–	–	1	5	23	8	32	6
	Solid state	28	1	5	5	39	85	40	231	30
	Cross-discipl. areas	3	–	1	3	6	11	5	37	1
	Other subfields	18	2	2	11	30	106	20	82	34
Graduate degree recipients	Terminal master's	10	1	1	5	5	11	6	26	9
	Doctorate	10	–	3	1	7	39	12	49	3

Table III quotes the total number of graduate students from the Enrollments and Degrees survey (9813) and estimates the students' distribution by major subfield and level of graduate study. One of the functions of this table is to give an indication of the approximate number of graduates within the major subfields who will be in the employment market shortly. The median number of years of graduate study spent to get a physics doctorate is 5.2. The overall distribution of subfields is very close to that of the previous year.

Table III. Graduate physics students by subfield and years of graduate study completed, 1978–79.

		Full-time equivalent years of graduate study								Total graduate students	
		≤ 1 yr.	2 yrs.	3 yrs.	4 yrs.	5 yrs.	6 yrs.	7 yrs.	8 yrs.	≥ 9 yrs.	N	%
Distribution* of students	N	2458	2021	1530	1344	1158	697	343	176	86	9813**	
	%	25.0	20.6	15.6	13.7	11.8	7.1	3.5	1.8	0.9		100.0
Physics subfields:												
Astrophysics		123	103	89	60	42	37	14	10	8	486	5.0
Biophysics		84	69	50	48	27	29	20	9	5	341	3.5
Electron, atomic, molecular		179	146	103	113	100	49	38	14	11	753	7.7
Elem. particles		290	230	191	172	170	106	35	23	17	1234	12.5
Math. physics		160	133	124	56	54	33	12	10	3	585	6.0
Nuclear physics		226	170	156	110	131	86	26	17	8	930	9.4
Optics		136	136	63	63	60	17	18	6	1	500	5.1
Plasmas		115	69	104	79	57	46	19	6	6	501	5.1
Solid state physics		690	588	456	460	405	222	118	64	26	3029	30.9
Other subfields incl. general physics		455	377	194	183	112	72	43	17	1	1454	14.8

* *The distribution of students in each subfield is based on the 6334 respondents to this question.*

** *This total was derived from the Survey of Enrollments and Degrees*

Table IV. Sources of support for graduate physics students by sex and degree status, 1978-79

Sources of support		Female	Male	Candidates for: Terminal master's	Master's enroute to PhD	PhD after master's	PhD only	Total N	Total %
Teaching assistantship		35%	34%	41%	45%	26%	30%	2115	33
Research assistantship		35	39	13	27	50	47	2451	39
Fellowship		11	10	5	9	10	13	614	10
Employment		10	9	25	3	7	3	570	9
Family, savings, loan		3	2	4	4	2	2	152	2
Other		2	3	7	3	3	2	242	4
Multiple sources of support, primarily with teaching assistantship		4	3	5	4	2	3	190	3
		100%	100%	100%	100%	100%	100%		
Total respondents	N	533	5801	895	1421	2443	1575	6334	
	%	8%	92%	14%	22%	39%	25%		100%

Candidacy for a specific degree influences the source of support a graduate physics student can expect to receive. The terminal master's degree candidates for example are less likely to be offered fellowships or research assistantships, and have the highest proportion of degree candidates who support themselves by means of off-campus employment. These statistics and others are presented in **Table IV.**

Table V. Number* of advanced graduate physics students specializing in selected experimental or theoretical subfields by years of graduate study completed, 1978-79.

Physics subfields	Type of research	Full-time equivalent years of graduate study: 3 yrs.	4 yrs.	5 yrs.	6 yrs.	7 yrs.	8 yrs.	≥ 9 yrs.	Total N	Total %	%
Astrophysics	experimental	35	20	22	15	4	6	2	104	3.5	
	theoretical	39	30	18	13	7	7	5	119		7.4
Biophysics	experimental	18	28	13	17	13	11	5	105	3.5	
Electron, atomic, molecular	experimental	65	69	54	33	22	15	16	274	9.3	
	theoretical	19	28	24	9	4	2	4	90		5.6
Elem. particles	experimental	96	89	100	61	22	24	9	401	13.5	
	theoretical	78	57	56	50	9	5	5	260		16.1
Math. physics	theoretical	120	63	50	41	13	9	11	307		19.1
Nuclear	experimental	85	50	83	68	20	13	5	324	10.9	
	theoretical	26	26	53	26	6	2	5	144		8.9
Optics	experimental	33	37	28	11	13	3	–	125	4.2	
Plasmas	experimental	59	43	35	26	7	4	7	181	6.1	
	theoretical	23	20	20	22	4	4	2	100		6.2
Solid state	experimental	295	295	281	149	87	53	32	1192	40.2	
	theoretical	85	98	82	59	15	16	6	361		22.4
Other subfields	experimental	69	62	50	44	16	7	6	254	8.8	
	theoretical	66	65	47	26	14	7	5	230		14.3
Total**	experimental	755	693	666	424	204	136	82	2960	100.0%	
	theoretical	461	387	350	246	72	52	43	1611		100.0%

* *The numbers in this table have been scaled up to reflect the total number of graduate students (5334) who completed three or more years of graduate study.*

** *In addition, to the graduate students working on an experimental or theoretical thesis there are an estimated 763 graduate physics students who describe their studies as both experimental and theoretical.*

Table VI. Type of research performed by doctoral candidates with respect to years of graduate study completed, 1978-79.

Type of research	Full-time equivalent years of graduate study 3 or 4 yrs.	5 or 6 yrs.	≥ 7 yrs.	Total ≥ 3 yrs.
Experimental	53%	56%	62%	56%
Theoretical	31	31	25	30
Both	16	13	13	14
Total	100%	100%	100%	100%
Number of students	2874	1855	605	5334

A noticeable change in sources of support from the previous year is an increase in the percentage of students with multiple sources of support. Furthermore, a change occurred in the distribution of assistantships for women graduate students. Not only is that distribution of assistantships becoming more like that for men, but also the percentage of teaching assistantships for women has dropped from around 45% in the early 1970's to 35% in 1978-79.

Many requests from the physics community concern physicists in a specific subfield and with a certain type of research. Although all level graduate students are asked to specify their areas of concentration, it is only from the third year on that identification of the subfields becomes more meaningful, and the students have made the decision on whether their dissertations are experimental or theoretical. **Table V** presents an array of doctoral candidates grouped by type of research, subfield, and years of graduate study completed. The information in this table also gives some indication of the time required to complete doctorates in the different subfields.

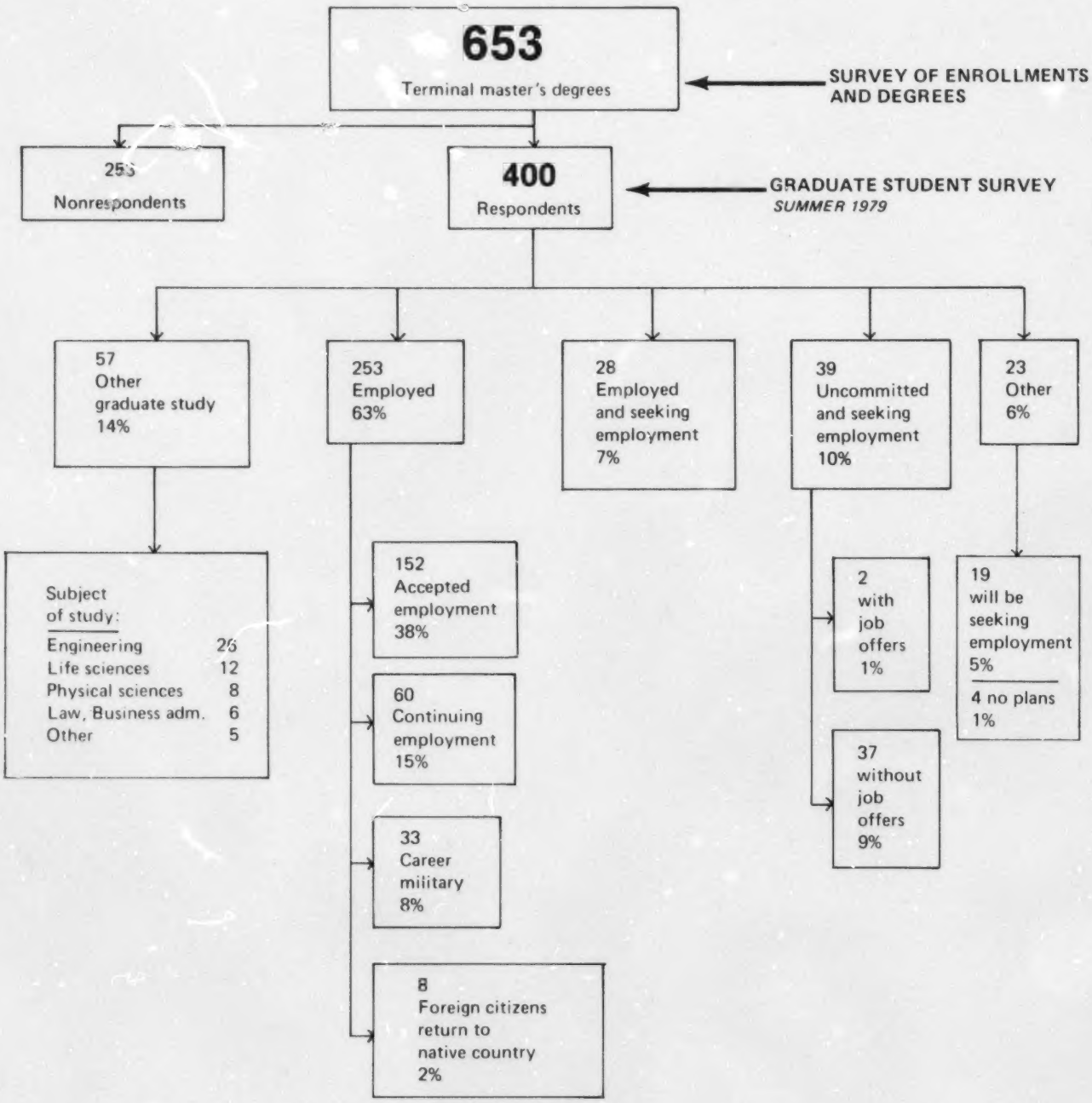
Combining all subfields **Table VI** focuses on the types of research and shows that a theoretical doctoral thesis appears to require less time than an experimental one.

Table VII analyzes the employment offers of 606 new physicists who are either committed to, or seeking a position, and relates these offers to the types of research and subfields of the dissertations. In particular, the table lists the major subfields and indicates whether the experimentalists or the theoreticians in a given specialty were in greater demand. For example 11% of the plasma physicists reported "zero job offers" at the time of this survey; but all of the experimentalists among that group had at least one employment offer. The bottom line of **Table VII** which summarizes employment opportunities for all the doctoral graduates, appears to indicate a greater demand for experimentalists than theoreticians.

Table VII. Employment offers for 1978-79 doctorate recipients by subfield and type of research

Physics subfield	Total in subfield	Percentage of graduates within subfield received: 0 offer	1 offer	≥ 2 offers	Type of research	Percentage of graduates within subfield received: 0 offer	1 offer	≥ 2 offers	
Astrophysics	5.5%	14%	43%	43%	exp.	0%	39%	61%	100%
Biophysics	2.9	7	53	40	exp.	0	44	56	100
Elec., atomic, molecular	8.6	2	56	42	exp.	0	56	44	100
Elem. particles	13.0	3	26	71	exp.	3	32	65	100
					theor.	6	35	59	100
Math. physics	7.3	11	38	51	theor.	9	41	50	100
Nuclear	10.5	2	42	56	exp.	0	36	64	100
					theor	7	57	36	100
Optics	4.5	4	36	60	exp.	0	44	56	100
Plasmas	6.5	11	30	59	exp.	0	39	61	100
Solid state	32.9	6	43	51	exp.	5	40	55	100
					theor.	5	60	35	100
Other	8.3	–	–	–		–	–	–	
Total	100.0%	6%	42%	52%	exp.	3%	40%	57%	100%
					theor.	10	50	40	100

Fig. III. Post-degree plans of physics terminal master's degree recipients, 1978-79.



The students who have chosen to terminate their study of physics at the master's level, generally do so to take advantage of a favorable job market; but that is not their only option. Other graduate study is a choice reported by 14% of those graduates and **Figure III** lists the major areas they switch to. The remaining flow diagram points to a substantial improvement in employment opportunities for physics masters since the previous year. For example the respondents classified as "employed" increased from 55% in 1978 to 63% in 1979, while in that same period, the group dissatisfied with its employment and referred to as "employed and seeking employment" declined from 9% to 7%. Only 10%, according to **Figure III**, are uncommitted and seeking employment, a decrease of 10 percentage points from the previous year.

Table VIII. Employment plans of terminal masters by subfield, 1978-79.

Physics subfield	Total in subfield	Employment offers received: 0	1	> 2	Total for each subfield
Acoustics	4.1%	13%[1]	73%	14%	100%
Astrophysics	5.1	0	62	38	100
Education	4.6	5	90	5	100
Electron, atomic, molecular	4.8	18	45	37	100
Engineering & Appl. physics	5.1	7	50	43	100
Nuclear	6.6	10	42	48	100
Optics	9.9	4	52	44	100
Solid state	25.7	19	43	38	100
Cross-discipl. areas	10.8	20	63	17	100
General physics	11.7	23	32	45	100
All other subfields	11.6	13	49	38	100
All subfields combined	100.0%	12%	52%	36%	100%
Total respondents	400*	37	168	115	

* *Includes 57 masters who go on to other graduate study and 23 who have other commitments.*

By elaborating on the post-degree plans presented in **Figure III**, and relating them to the subfields those masters pursued in graduate school, we arrive at **Table VIII**. Since this table lists ten subfields, the numbers of respondents in each is small, a fact one should keep in mind when interpreting the "zero job offers" column.

Perhaps it is surprising that "general physics" should have the highest percentage of "zero job offers" among the subfields when employers over the years seek broadly-educated graduates whom they can enter in their own training programs. On the other hand master's programs in the more applied specialties like optics, appear to prepare their graduates so well that nearly all of them are offered positions upon graduating. The distribution of subfields, when compared with that of the previous year shows increases in acoustics, optics and solid state physics, and a decrease in nuclear physics.

There were 281 masters who reported an employer and a current work activity irrespective of their desire to change that current employment, and **Table IX** presents these data. The major changes in work activities from the previous year are a smaller proportion of new masters in research and a larger proportion in engineering. The group reporting a nonphysics professional work activity was so small in 1978 that it was included under "other"; in 1979 it comprises 7%. The 60 respondents employed by the government include 33 who start a military career. Teaching has declined four percentage points in one year, and only nine masters are foreign graduates who remain in the U.S. for initial employment.

Table IX. Type of employer and work activity of physics terminal masters, 1978-79.

Work activity		Sec. school	Coll.	Univ.	Industry	Gov't.	FFRC	Other	Total N	Total %
Teaching		23	6	7	–	3	–	–	39	14
Research		–	–	7	7	9	3	–	26	9
Res. and dev.		–	–	2	58	14	6	2	82	29
Engineering		–	–	–	62	14	–	–	76	27
Computer scie.		–	–	–	22	–	–	–	22	8
Nonphysics prof'l		–	–	–	1	18	–	1	20	7
Other		–	2	6	6	2	–	–	16	6
Total	N	23	8	22	156	60	9	3	281	
	%	8	3	8	56	21	3	1		100%

Fig. IV. Background characteristics and post-doctorate status of 1978–79 physics graduates

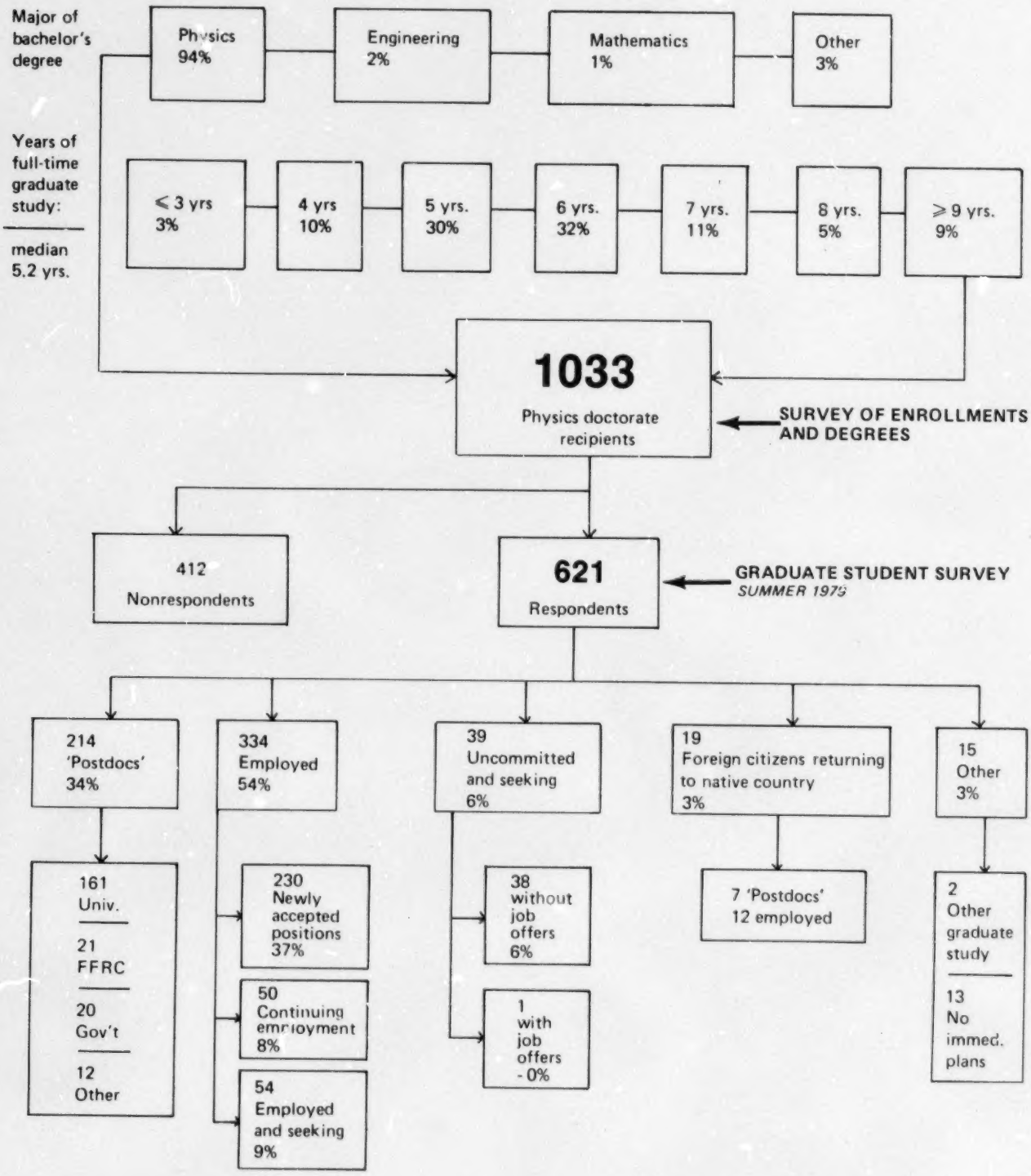


Figure IV presents the background characteristics and post-doctorate status of 1978-79 physics graduates. Their background characteristics show a decrease in the percentage of doctoral graduates, from 33% to 25%, who take more than six years to complete the PhD. A change of this kind generally indicates an improved job market; however, the percentage of graduates who accepted 'postdocs' increased by five percentage points. In the early 1970's such a change in one year would have signaled a shortage of potentially permanent positions, which, from other reports, has not been the case in 1979.

Table X. Use of physics in potentially permanent employment of graduate degree recipients, 1978–79.

	Type of employer	Use of physics training: Extensive with respect to method	Extensive with respect to subject matter	Little with respect to method	Little with respect to subject matter	None with respect to method	None with respect to subject matter	Total reporting N
Doctorate recipients	Univ.-tenurable	90%	85%	10%	15%	–	–	26
	Univ.-nontenurable	90	85	5	13	5%	2%	61
	4-yr. coll.	62	85	38	15	–	–	13
	Industry	78	50	20	36	2	14	135
	Government	75	68	25	24	–	8	25
	FFRC	97	72	3	28	–	–	30
	Other	45	67	55	33	–	–	13
	Total	81%	67%	17%	27%	2%	6%	303

		Use of physics training with respect to subject matter: Extensive	Little	None	Total reporting
Terminal masters	Educational institution	77%	21%	2%	48
	Industry	49	42	9	128
	FFRC/Gov't	80	18	2	49
	Other	–	100	–	2
	Total	61%	33%	6%	227

Having related the subfields to the employment offers, attention can be focused on those who have started employment and can evaluate their use of physics training with respect to subject matter as well as method. Where the doctorate recipients are concerned it can be assumed that graduates who accepted postdoctoral fellowships are making extensive use of their training and frequently continue their research in the same subfield. For that reason **Table X** excludes all 'postdocs' and concentrates on graduates with potentially permanent employment.

For the first time in 1979 the distinction was made between subject matter and method in one's use of physics training. Thus we found that at the master's level it is the subject matter that assumes greater importance, whereas with doctoral graduates, utilizing their research methods is a major consideration when accepting potentially permanent positions. For the doctorate recipients in **Table X**, both uses of physics training are shown; for the masters only "use of subject matter" is presented.

Where 78% of the doctors in industrial positions report "extensive use of training" with regard to method, only 50% of that same group are making extensive use of their subject matter. The respondents among the masters made few distinctions between subject matter and method when describing their use of physics training.

Starting salaries are presented in **Table XI** and include only those of graduates who accepted new positions; degree recipients who continued their work with the same employer and without a promotion to a new position are excluded from this table. The median monthly salary of new masters has risen by almost 10% between 1978 and 1979. Only eight of the women among the masters reported their starting salaries and six out of the eight accepted industrial positions.

Postdoctoral fellowships always entail a lower salary than positions with potential permanence, therefore **Table XI** presents the two groups of salaries in separate columns. The overall increase from the previous year is 7% for the fellowships most of which are paid by universities; the doctoral positions with potential permanence showed an increase of 16%. Industrial positions which pay the highest salaries were accepted by a greater proportion of the new doctoral graduates in 1979 than in previous years. The median salary reported by those who accepted employment with the government remained the same between 1978 and 1979, and the increase for college teaching positions was less than 2.5%.

Table XI. Median monthly salaries paid by U.S. employers to new physics graduates, 1978–79.**

Type of employer	Terminal master's recipients: Percentage accepting positions	Terminal master's recipients: Monthly starting salaries	Doctorate recipients: Percentage accepting 'Postdocs'	Doctorate recipients: Percentage accepting Potentially permanent pos.	Monthly starting salaries for: 'Postdocs'	Monthly starting salaries for: Potentially permanent pos.
Secondary school	5%	$1250	–	–	–	–
4-year college	3	*	–	3%	–	$1280
University	6	*	30%	17	$1170	1330
Industry	75	1630	–	27	–	2065
Government	4	1450	4	5	1530	1650
Fed. Funded Res. Ctr.	3	*	4	6	1400	1830
Other	4	1450	2	2	1150	1450
All employers	100%	$1590	100%		$1210	$1880

* *Fewer than ten graduates reported salaries.*

** *Salaries shown in this table are based on newly accepted positions.*

Table XII. Type of employment and citizenship of physics doctorate recipients, 1978–79.

Type of employment		in the U.S.		outside the U.S.		Total
		Citizenship U.S.	Foreign	Citizenship U.S.	Foreign	
'Postdoc'		137	38	5	7	187
Potentially permanent		232	47	4	12	295
Total	N	369	85	9	19	482
	%	76%	18%	2%	4%	100%

Unlike the 1960's when physicists were in demand in the U.S., the recession of the early and mid-1970's encouraged the majority of foreign graduates from U.S. universities to return to their native countries for initial employment. However, from 1977 on, this situation appears to have changed. **Table XII** focuses on the doctoral graduates and distinguishes between foreign and U.S. doctorate recipients. Furthermore, initial employers of these graduates are divided into U.S. and foreign, as well as by type of employment they offer; the two numbers in **Table XII** which indicate an improved job market in the late 1970's are: 18% foreign graduates who remain in the U.S. for their initial employment, and only 2% U.S. citizens who accepted initial employment outside the U.S. The 18% represents a change from 13% in 1977 and 15% in 1978, while the 2% represents a change from 3% in the two previous years.

ASTRONOMY

Now in its fifth year, the Survey of Graduate Astronomy Students is based on data contributed by 500 astronomy students enrolled in 49 graduate astronomy departments. Of those, 34 are separate graduate astronomy departments and 15 are combined with graduate physics departments. Reports from the department chairmen to another survey indicate a recent levelling trend of the graduate astronomy enrollment at 700 students, a decline from approximately 800 students enrolled during the mid 1970's.

Table XIII. Graduate astronomy students by subfield and years of graduate study completed, 1978–79.

		Full-time equivalent years of graduate study						Total graduate students	
		≤ 1 yr.	2 yrs.	3 yrs.	4 yrs.	5 yrs.	≥ 6 yrs.	N	%
Distribution of students	N	145	135	130	113	99	88	710*	
	%	20	19	18	16	14	13		100
Astronomy subfields									
Astronomical instruments and techniques		6%	5%	4%	10%	1%	8%	41	6%
Cosmology, extragalactic objects, quasi-stellar objects		17	20	28	19	23	15	146	21
Galactic structure, stellar motions		9	3	4	14	4	6	48	7
Interstellar matter and gaseous nebulae		10	12	10	21	17	13	95	13
Solar system, space astronomy of the solar system		6	9	9	3	3	5	43	6
Stellar atmospheres and spectra, stellar evolution, solar and stellar interiors		15	18	23	14	26	35	154	22
Supernovae, X, γ and cosmic rays, pulsars		5	8	5	5	10	3	42	6
The sun		1	5	2	4	6	6	28	4
Astrophysics		17	10	10	5	7	6	67	9
All other subfields combined		14	10	5	5	3	3	46	6
		100%	100%	100%	100%	100%	100%		100%

* *The percentages shown in this table are based on 503 respondents to the Graduate Student Survey. Astronomy department chairmen reported a total of 710 graduate students for the Survey of Enrollments and Degrees.*

Table XIII presents the distribution of graduate students by level of graduate study and lists nine major subfields including astrophysics. Only 38% of the astronomy students describe their research as observational compared with 52% of the physics students who are experimentalists.

Table XIV lists eight characteristics of all graduate astronomy students as well as for three subgroups: the first-year graduate students, the terminal master's degree recipients and the doctorate recipients. When compared with the graduate physics students, the astronomy students include a higher proportion of women and a lower proportion of foreign students. The majority of them majored in physics as undergraduates which can be attributed to the fact that only 57 institutions in the U.S. offer an astronomy bachelor's degree.

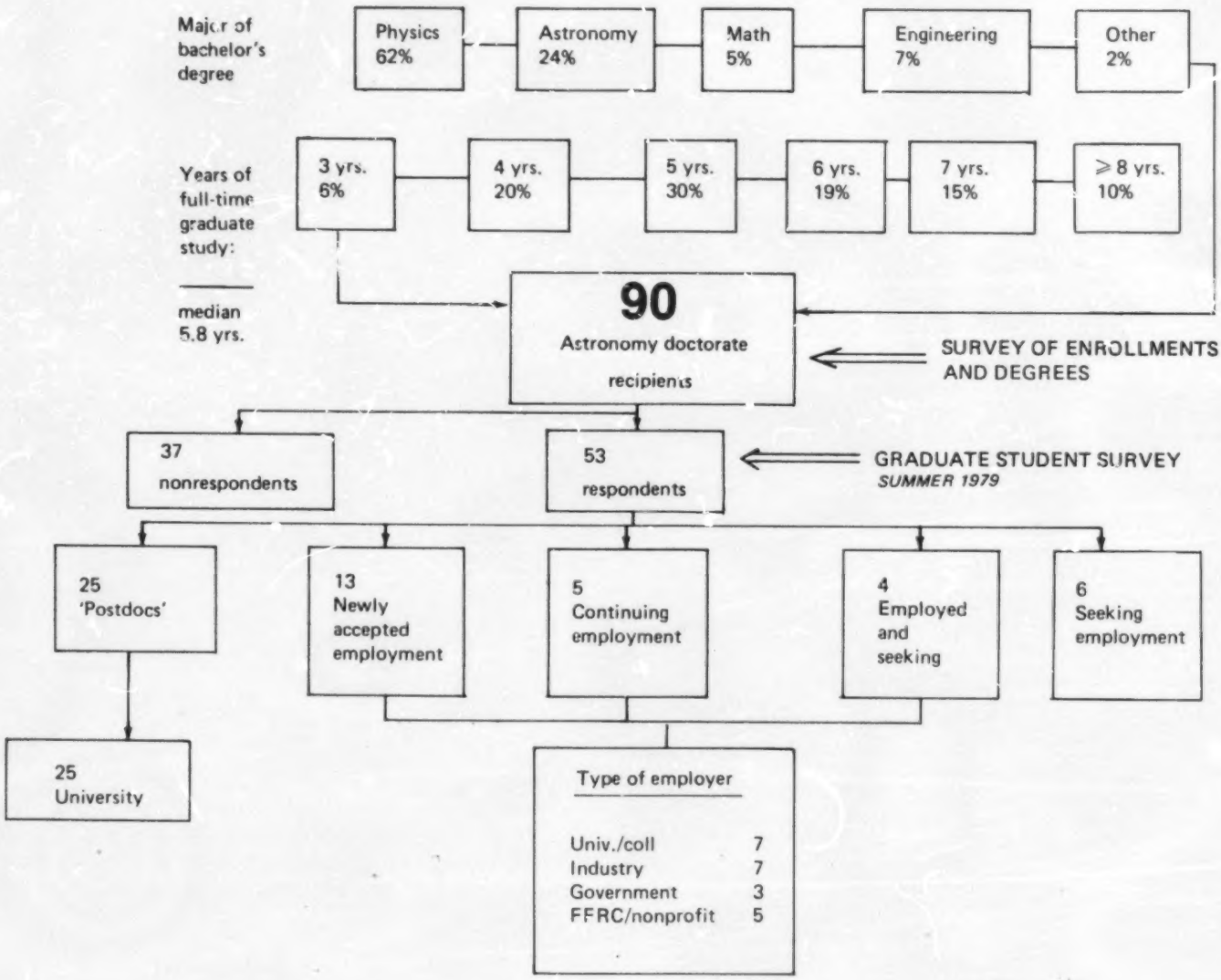
Table XIV. Characteristics of astronomy graduate students, terminal master's degree and doctorate recipients, 1978–79.

Characteristics		All graduate students	First-year graduate students	Terminal master's degree recipients	Doctorate recipients
	Total Population*	710	145	42	90
	Number of respondents	503	82	25	53
Sex	Female	14%	15%	12%	7%
	Male	86	85	88	93
Citizenship	U.S.	89%	86%	100%	82%
	Foreign	11	14	–	18
Type of High school physics	PSSC**	33%	32%	36%	37%
	Project physics	5	6	5	–
	Other	54	54	50	53
	None	8	8	9	10
Major of bachelor's degree	Astronomy	38%	40%	24%	40%
	Physics	53	52	62	56
	Math	4	2	5	4
	Engineering	2	5	7	–
	Other	3	1	2	–
Type of bachelor's institution	Ph-D-granting	66%	64%	60%	64%
	MS-granting	7	6	16	–
	BS/BA-granting	18	17	24	19
	Foreign	9	13	–	17
Type of graduate institution	PhD-granting	97%	94%	88%	100%
	MS-granting	3	6	12	–
Student status	Full-time	90%	96%	80%	86%
	Part-time	10	4	20	14
Source of support	Teaching assist.	31%	49%	48%	4%
	Research assist.	39	17	20	50
	Fellowship	14	21	4	17
	Employment	11	5	20	22
	Family, savings, loan	3	8	8	6
	Other	2	–	–	1

* *These totals were reported by astronomy department chairmen as of the Survey of Enrollments and Degrees.*

** *The Physical Science Study Committee (PSSC) course material became available for general use in 1960. Since the late 1960's the percentage of graduate physics students who took PSSC in high school has increased and levelled off.*

Fig. V. Background characteristics and post-doctorate status of 1978–79 astronomy doctorate recipients



The number of astronomy doctorates granted between July 1978 and June 1979 was reported to be 90. While the median number of years of graduate study spent on the doctorate increased from 5.2 years to 5.8 years, the percentage of students taking eight or more years decreased from 17% to 10%. The data on the 53 doctoral respondents presented in Figure V show little change from those of the previous year.

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